

1 REFUSE COLLECTION VEHICLE AND METHOD WITH  
2 STACKABLE REFUSE STORAGE CONTAINER

3  
4 FIELD OF THE INVENTION

5  
6 This invention relates to refuse collection.

7  
8 More particularly, the present invention relates to the  
9 collection and transport of refuse.

10  
11 In a further and more specific aspect, the instant  
12 invention concerns a stackable container for storing and  
13 transporting collected refuse.

14  
15 BACKGROUND OF THE INVENTION

16  
17 Refuse collection has long been required and will continue  
18 to be needed. There are many types of refuse collection  
19 vehicles, containers and systems that have been developed over  
20 the years. Many of the vehicle improvements have focused on  
21 automating the refuse collection process. Thus, the speed and  
22 efficiency in which refuse is collected has dramatically  
23 increased. Unfortunately, the cost of the vehicles has also  
24 increased with the automation. Since the vehicles are only  
25 more efficient in the collection of refuse, the time it takes  
26 to transport and offload the refuse severely reduces  
27 inefficiency and increases the cost of handling refuse.

1        Even refuse collection vehicles that have been known for  
2 many years use specialized equipment, such as a hopper for  
3 receiving refuse and a packer mechanism for moving the refuse  
4 into a collection body. This equipment adds expense and weight  
5 to the vehicle which reduces efficiency and increases cost  
6 during the transport of the refuse.

7  
8        Various techniques and systems have been developed to try  
9 and maximize the efficient use of automated vehicles and other  
10 refuse collection vehicles having refuse handling devices.  
11 Transfer stations are one solution. In this instance, refuse  
12 is offloaded at a central facility and repackaged for  
13 transport. While increasing the time automated or other  
14 specialized vehicles are used for collection, transfer stations  
15 are expensive to operate and labor intensive.

16  
17        A very effective system incorporates a removable container  
18 on a refuse collection vehicle. In this system, a vehicle  
19 collects refuse in a container using a rear loading mechanism.  
20 The container can then be removed from the vehicle and  
21 transported by conventional container vehicles to a desired  
22 location. In this manner, the vehicle can be continually  
23 employed for refuse collection, while another vehicle can be  
24 used for transportation of the container. The primary problem  
25 with this system is that while the specialized collection  
26 devices are used at maximum efficiency, the transport vehicles  
27 are required to carry loaded containers in one direction and

1 empty containers on the return trip. Thus, the efficiency of  
2 the transport vehicles is not maximized.

3

4 It would be highly advantageous, therefore, to remedy the  
5 foregoing and other deficiencies inherent in the prior art.

6

7 Accordingly, it is an object of the present invention to  
8 provide a new and improved refuse collection vehicle.

9

10 Another object of the invention is to provide a new and  
11 improved stackable container for use on a refuse collection  
12 vehicle.

13

14 And another object of the invention is to provide an  
15 efficient method of collecting and transporting refuse  
16 employing a stackable container.

17

18 Still another object of the present invention is to  
19 provide a system for the efficient use of refuse collection  
20 vehicles and transport vehicles.

## SUMMARY OF THE INVENTION

Briefly, to achieve the desired objects of the instant invention in accordance with a preferred embodiment thereof, provided is stackable refuse collection container and refuse collection vehicle. The refuse collection vehicle includes a chassis carrying a compaction mechanism. The stackable refuse collection container is removably carried by the chassis adjacent the compaction mechanism. The container includes a body having a bottom and an open top, the body constructed to be nestingly stacked with at least one similar body through the open top. A cover is provided and formed to engage the body and close the top. An engagement mechanism is coupled to the body and the cover, the engagement mechanisms moveable between an engaged position securing the cover onto the body to allow compaction of refuse therein by the compaction mechanism, and a disengaged position permitting removal of the cover from the open top. A loading door is formed in an end of the body adjacent the compaction mechanism for receiving refuse from the compaction mechanism.

Also provided is a method of collecting refuse including the steps of providing a refuse collection vehicle including a chassis carrying a compaction mechanism. A plurality of empty stackable refuse collection container are provided, the plurality of containers each including a body having a bottom and an open top constructed to be nestingly stacked with at

1     least one of the remaining plurality of containers through the  
2     open top. A cover is formed to engage the body and close the  
3     top. An engagement mechanism is coupled to the body and the  
4     cover, the engagement mechanisms moveable between an engaged  
5     position securing the cover onto the body to allow compaction  
6     of refuse therein by the compaction mechanism, and a disengaged  
7     position permitting removal of the cover from the open top, and  
8     a loading door formed in an end of the body. An empty first  
9     one of the plurality of containers, with an engaged cover, is  
10    mounted on the chassis of the refuse collection vehicle with  
11    loading door positioned adjacent the compaction mechanism for  
12    receiving refuse from the compaction mechanism. Refuse is  
13    introduced and compacted in the first one of the plurality of  
14    containers using the compacting mechanism. The first one of  
15    the plurality of containers with compacted refuse therein is  
16    removed from the chassis, and an empty second one of the  
17    plurality of containers is mounted on the chassis of the refuse  
18    collection vehicle with loading door positioned adjacent the  
19    compaction mechanism for receiving refuse from the compaction  
20    mechanism.

1 BRIEF DESCRIPTION OF THE DRAWINGS

2  
3 The foregoing and further and more specific objects and  
4 advantages of the instant invention will become readily  
5 apparent to those skilled in the art from the following  
6 detailed description of preferred embodiments thereof taken in  
7 conjunction with the drawings, in which:

8  
9 FIG. 1 is a perspective view illustrating a refuse  
10 collection vehicle and container according to the present  
11 invention;

12  
13 FIG. 2 is a side view of the container of FIG. 1;

14  
15 FIG. 3 is a top view of the container of FIG. 2, with  
16 portion thereof cut away;

17  
18 FIG. 4 is an end view of the container of FIGS. 2 and 3;

19  
20 FIG. 5 is a partial perspective view of a top roller of  
21 the container;

22  
23 FIG. 6 is a partial side view of the container with a  
24 cover removed therefrom;

1           FIG. 7 is a partial sectional side view of the container  
2   and cover;

3

4           FIG. 8 is a partial sectional side view of the container  
5   and lower roller;

6

7           FIG. 9 is a partial perspective view of the container and  
8   cover, with portions thereof broken away to illustrate an  
9   engagement mechanism;

10

11           FIG. 10 is a partial sectional side view illustrating the  
12   engagement mechanism of FIG. 9 in the engaged position;

13

14           FIG. 11 is a partial perspective view illustrating an end  
15   of the container;

16

17           FIG. 12 is a partial sectional end view illustrating the  
18   upper rollers of a pair of stacked containers;

19

20           FIG. 13 is a partial end view illustrating a container on  
21   a roll-on chassis;

22

23           FIG. 14 is a simplified side view illustrating a method of  
24   stacking containers of the present invention;

1           FIG. 15 is an end view illustrating stacked containers  
2 according to the present invention;

3

4           FIG. 16 is a simplified side view illustrating a container  
5 being loaded into a van according to the present invention;

6

7           FIG. 17 is a simplified side view illustrating another  
8 method of stacking the containers according to the present  
9 invention;

10

11           FIG. 18 is a simplified side view of a vehicle carrying  
12 stacked containers;

13

14           FIG. 19 schematically illustrates various steps A-G in a  
15 sequence of collecting refuse in a container, transporting and  
16 returning the container according to a method of the present  
17 invention;

18

19           FIG. 20 is a perspective view illustrating another  
20 embodiment of a refuse collection vehicle and container  
21 according to the present invention;

22

23           FIG. 21 is a simplified side view of a packing mechanism  
24 and loading door of a container according to the present  
25 invention;



1           FIG. 22 is a simplified side view of another packing  
2 mechanism and loading door of a container according to the  
3 present invention; and  
4

5           FIG. 23 is a simplified side view of yet another packing  
6 mechanism and loading door of a container according to the  
7 present invention.

1                    DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

2

3            Turning now to the drawings in which like reference

4            characters indicate corresponding elements throughout the

5            several views, attention is first directed to FIG. 1 which

6            illustrates a refuse collection vehicle generally designated

7            10. Vehicle 10 includes a chassis 12, a cab 14 carried at one

8            end thereof and a tailgate assembly 18 carried at an opposing

9            end of chassis 12. A container 20 is carried intermediate cab

10           14 and tailgate assembly 18. Tailgate assembly 18 will not be

11           described in detail as it is fully described in co-pending

12           provisional patent application serial number 60/399,942, filed

13           30 July 2002, entitled REAR LOADER COLLECTION VEHICLE WITH

14           DETACHABLE CONTAINER, included by reference herein and is only

15           one of many possible loading mechanisms. Assembly 18 loads

16           refuse into container 20. Container 20 can then be removed and

17           transported to a desired site, as will be described presently.

18

19           With additional reference to FIGS. 2-4, container 20

20           includes a body 21 which includes opposing side walls 22 and 23

21           joined by opposing end walls 24 and 25. An upper edge of body

22           21 is formed by substantially parallel top rails 27 and 28 and

23           end rails 29 and 30. Side walls 22 and 23, and end walls 24

24           and 25 slant inwardly toward a bottom 32 to define a volume

25           larger at the top than at the bottom. In other words, an area

26           of the open top is larger than the area of the bottom. In this

1 manner, body 21 can be stacked within another body 21 in a  
2 nesting arrangement for purposes to be described presently.  
3 Substantially parallel bottom rails 33 and 34 extend along an  
4 outer surface of bottom 32 from end wall 24 to end wall 25. A  
5 pair of apertures 38 extends through top rail 27, aligned with  
6 a pair of apertures (not shown) in top rail 28. Another pair  
7 of apertures 39 extends through bottom rail 33, aligned with a  
8 pair of apertures (not shown) in bottom rail 34.

9  
10 Container 20 further includes a cover 40 overlying and  
11 securely engageable to top rails 27 and 28 of body 21. Cover  
12 40 includes a frame 42 having side rails 43 and 44, joined by  
13 end rails 45 and 46. Frame 42 is sized to correspond with and  
14 overlie top rails 27 and 28 and end rails 29 and 30. A cover  
15 panel 48 is positioned within frame 42 to complete cover 40.  
16 Cover panel 48 may be curved as shown, to provide increased  
17 rigidity and strength. This becomes important to permit  
18 compaction of refuse within container 20. While apertures 38  
19 are shown formed through top rails 27 and 28 in FIG. 2, it will  
20 be understood that apertures, designated 38' here to indicate a  
21 different embodiment, can extend through rails 43 and 44 of  
22 cover 40, if desired. Alternatively, other lifting structures  
23 can be provided, such as brackets affixed to frame 42 by some  
24 convenient method, e.g. welding or the like, to define  
25 openings.

1           Referring additionally to FIGS. 6, 9, and 10, an  
2   engagement mechanism, generally designated 50, is illustrated  
3   for securing cover 40 to body 21. Engagement mechanism 50  
4   includes a shaft 52 positioned within and parallel to side rail  
5   43 of cover 40. Shaft 52 is rotatably mounted at opposite ends  
6   in end rails 29 and 30 of cover 40. One or both of the ends of  
7   shaft 52 are accessible at the exterior for receiving a handle  
8   54. Handle 54 is employed to rotate shaft 52 for movement of  
9   mechanism 50 between an engaged position and a disengaged  
10   position as will be described presently. A latch 56 is carried  
11   by shaft 52 and extending downwardly from rail 43 to engage an  
12   anchor 58 carried by top rail 27. In the embodiment  
13   illustrated in FIG. 9, latch 56 is simply a hook rotated by  
14   shaft 52 so as to engage anchor 58 in the engaged position.  
15   Anchor 58 is a fixedly mounted horizontal rod carried within  
16   top rail 27. Latch 56 extends through a slot formed in top  
17   rail 27 to access anchor 58. Turning to FIG. 10, a locking  
18   latch 56' is illustrated. Latch 56' is mounted to shaft 52  
19   with a linkage 59. Linkage 59 is fixedly coupled to shaft 52  
20   for rotation therewith. Latch 56' is pivotally attached to  
21   linkage 59. By providing linkage 59, latch 56' can be locked  
22   into the engaged position by rotating shaft 52 to a position  
23   wherein linkage 59 is over center. It should be understood  
24   that while a single latch is illustrated, a plurality of  
25   latches may be affixed to shaft 52 with associated anchors.  
26   Additionally, a similar shaft and latch arrangement is carried

1 by side rail 44 of cover 40 and anchors by top rail 28 of body  
2 21 to complete engagement mechanism 50. Also, it should be  
3 understood that latches 56 can instead be carried by top rail  
4 27 and/or top rail 28 and anchors 58 carried by side rail 43  
5 and/or side rail 44. It is also contemplated that one side of  
6 cover 40 may be hingedly attached to body 21 and only the  
7 opposing side including engagement mechanism 50. To provide  
8 covers hanging in the manner shown in FIG. 15, offset hinges  
9 can be employed.

10  
11 It will be understood by one skilled in the art, that  
12 while shafts 52 have been described as extending substantially  
13 the length of rails 43 and 44, in the embodiment illustrated in  
14 FIG. 1, short shaft segments on each corner would be employed.  
15 Shafts extending the entire length are not employed in this  
16 embodiment due to the presence of apertures 38' formed in cover  
17 40.

18  
19 Referring to FIGS. 2, 4, 5 and 7 lower rollers 60 are  
20 mounted on bottom rails 33 and 34 to facilitate movement of  
21 container 20 on a planar surface for purposes which will be  
22 described presently. Upper rollers 62 are mounted in top rails  
23 27 and 28 and directed downwardly so as to extend below a lower  
24 portion thereof. Lower roller 60 and upper rollers 62 are  
25 preferably mounted adjacent the corners of body 21. It should  
26 be understood that rollers 60 and 62 are optional and can be

1 omitted if desired. An anchor 65 is carried within an inset  
2 formed in body 21 proximate bottom 32. Anchor 65 permits  
3 engagement of a winch line 66 (see FIG. 8) for moving body 21.  
4 It will be understood that an anchor can be provided at one or  
5 both ends of body 21.

6  
7 Referring back to FIG. 1, with additional reference to  
8 FIG. 11, container 20 is intended to be employed with a loading  
9 mechanism such as tailgate 18. Thus, end wall 24 includes a  
10 loading door 70, which can have many different forms depending  
11 on the loading mechanism employed, some of which will be  
12 described presently. Additionally, while refuse can be  
13 discharged from body 21 from the top when cover 40 is removed,  
14 end wall 25 can be hinged to provide an egress for refuse. In  
15 this case, end wall 25 is hinged or pivoted adjacent the top  
16 and pinned at the bottom with pins 72. In this manner, when  
17 pins 72 are removed, refuse can be discharged from the end of  
18 container 20.

19  
20 Turning now to FIGS. 14 and 15, covers 40 are removed  
21 allowing bodies 21 to be stacked in a nesting arrangement for  
22 shipment. This can be accomplished using a fork lift 75, or  
23 the like as shown in FIG. 14. In this case, the forks of lift  
24 75 are inserted through apertures 38, allowing body 21 to be  
25 lowered into another body 21. It will also be understood by  
26 those skilled in the art that cover 40 can remain on a body to

1 be stacked. In this case, the forks of lift 75 are inserted  
2 through apertures 38'. Cover 40 can then be removed to permit  
3 stacking of additional bodies 21. Referring specifically to  
4 FIG. 15, one bodies 21 are nestingly stacked, covers 40 can be  
5 positioned as illustrated.

6  
7 Referring to FIG. 17, another method of stacking bodies 21  
8 is illustrated. In this method, a roll off vehicle 77 is  
9 carrying body 21. A ramp 78 is utilized to position vehicle 77  
10 above the stack of bodies 21. In the stacking operation, a bed  
11 80 of roll off vehicle 77 is raised and a winch 82 is employed  
12 to lower body 21 onto the stack. It will be understood that  
13 roll-off vehicle 77 is of conventional design, and includes a  
14 plurality of rollers 84 upon which bottom rails 33 and 34 ride,  
15 as can be seen in FIG. 13. To facilitate nesting stacking, and  
16 reduce wear and possible damage to bodies 21, upper rollers 62  
17 ride upon the upper surface of upper rails 27 and 28 of any  
18 previously stacked bodies (see FIG. 12).

19  
20 Referring now to FIG. 19, A-G, a method of collecting and  
21 transporting refuse is illustrated. By this method, refuse  
22 collecting devices are employed for the specialized purposes of  
23 collecting refuse and not transporting refuse. Transport  
24 vehicles, not having the specialized collection devices, are  
25 used to transport materials in both directions, so as to reduce  
26 or eliminate empty loads. In FIG. 19 step A shows a refuse

1 collection vehicle 100 of the side loader type. Side loader  
2 vehicle 100 is illustrated in more detail in FIG. 20. It will  
3 be understood that the refuse collection vehicle can be any  
4 vehicle capable of carrying container 20 and loading refuse  
5 therein, such as vehicle 10 having tailgate 18. Vehicle 100  
6 collects, compacts and stores refuse within container 20.

7  
8 Container 20 is then removed from vehicle 100 by a fork  
9 lift 102 (step B) and inserted into a transport vehicle, such  
10 as van 104 (step C). After removing a filled container 20, it  
11 will be understood that forklift 102 can then place an empty  
12 container 20 onto vehicle 100. With additional reference to  
13 FIG. 16, fork lift 102 slides container 20 into van 104 using  
14 rollers 60 (if present). Van 104 is an example of a transport  
15 vehicle, which generally can be any of a semi-trailer in an  
16 articulated vehicle, a fixed body truck, a flatbed trailer,  
17 etc. It will be understood that roll off vehicle 77 can also  
18 be used as a transport vehicle. In a typical scenario, van 104  
19 brings a load of material to a location, and leaves with a  
20 filled container 20 for delivery to a desired location, thereby  
21 employing van 104 for substantially one hundred percent of the  
22 time instead of fifty percent.

23

24 Step D includes removing container 20 from the transport  
25 vehicle, e.g. van 104, when it reaches the desired location.  
26 Removal is preferably accomplished employing roll off vehicle



1 77. Container 20 is removed from van 104 using winch 82 and  
2 moved onto bed 80 of roll off vehicle 77. Roll off vehicles,  
3 such as vehicle 77, are widely used in the industry for a  
4 variety of applications, e.g. delivering and picking up roll  
5 off containers at private and industrial locations. Roll off  
6 vehicles are generally available at refuse disposal sites,  
7 either as a vehicle that happens to be present or as a  
8 dedicated vehicle supplied by the owner of the site or the  
9 company using vehicles 100 and containers 20. In step E, roll  
10 off vehicle 77 empties container 20 using a ramp 106 provided  
11 for that purpose (if necessary). In this specific example,  
12 refuse is discharged through wall 25, after releasing pins 72.

13

14 After emptying container 20, roll off vehicle 77 moves to  
15 ramp 78 and stacks the recently emptied container 20 onto a  
16 stack 110 of previously emptied and stacked containers 20,  
17 generally as previously described with reference to FIG. 17.  
18 When stack 110 reaches a desired number, generally three  
19 containers 20, roll off vehicle 77 backs up to stack 110 and  
20 loads the entire stack onto bed 80, depicted as step G. In  
21 this embodiment cover 40 for each container 20 are stacked on  
22 top of stack 110. At this point, vehicle 77 can return the  
23 empty containers, or transfer the stacks to a vehicle 115 as  
24 shown in FIG. 18. In this embodiment, flatbed trailers 117 and  
25 118 are towed behind vehicle 115. Each of trailers 117 and 118  
26 can include winches 120 for pulling stacks 110 onto the

1     respective trailer from roll off vehicle 77.     It will be  
2     understood that larger trailers may be capable of carrying  
3     multiple and/ or larger stacks.     Furthermore, some roll off  
4     vehicles or trailers employ a loading arm instead of a winch.  
5     In these cases, the arm can be used in place of the winch for  
6     the loading of stacks 110.     The arm pushes or pulls the  
7     containers.     Stacks 110 are then returned for refilling,  
8     completing the cycle.

9

10         As discussed previously, refuse collection vehicles and  
11     their associated loading and compacting mechanisms can be any  
12     of a variety of well known devices.     Examples of typical  
13     loading mechanisms include Fig. 1 which specifically  
14     illustrates a rear loading mechanism as provided by tailgate  
15     18, and FIG. 20 which illustrates a side loading mechanism  
16     which includes a hopper and compactor at the front of container  
17     20.     Loading door 70 of container 20 is configured to cooperate  
18     with the selected loading and compacting mechanisms.     FIG. 21,  
19     for example, illustrates a specific loading door associated  
20     with tailgate 18 and disclosed in the above identified  
21     provisional application incorporated herein.     FIG. 22 shows  
22     another type of loading door associated with a side loading  
23     mechanism having a compactor at the font of container 20.     In  
24     this example, a loading door 125 is lifted by a mechanism not  
25     shown to permit a compactor 127 to compact refuse therethrough.  
26     Turning to FIG. 23, another loading door 130 is illustrated

1 with associated compactor 132. In this example, loading door  
2 130 is fastened to compactor 132 during the collection and  
3 compacting process. When container 20 is sufficiently filled,  
4 compactor 132 positions loading door 130, which is then  
5 fastened to container 20 in position, and unfastened from  
6 compactor 132. As stated previously, one skilled in the art  
7 will understand that container 20 can be employed with  
8 substantially any type of loading and compacting mechanisms.  
9 Additionally, substantially any combination of the preceding  
10 vehicles can be used in a system for collecting and  
11 transporting refuse.

12

13 Thus, a new and improved stackable container for use on a  
14 refuse collection vehicle has been disclosed. This container  
15 allows an efficient method of collecting and transporting  
16 refuse as well as the efficient use of refuse collection  
17 vehicles and transport vehicles.

18

19 Various changes and modifications to the embodiments  
20 herein chosen for purposes of illustration will readily occur  
21 to those skilled in the art. To the extent that such  
22 modifications and variations do not depart from the spirit of  
23 the invention, they are intended to be included within the  
24 scope thereof which is assessed only by a fair interpretation  
25 of the following claims.

1           Having fully described the invention in such clear and  
2   concise terms as to enable those skilled in the art to  
3   understand and practice the same, the invention claimed is: